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CASE REPORT

Ultrasound-guided Transcutaneous Embolization of Uterine Arteriovenous Fistula Performed for Treatment of Symptomatic, Heavy Vaginal Bleeding: Case Report with Brief Review of Literature

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Abstract Embolization of uterine arteriovenous malformations is usually performed angiographically via transfemoral arterial approach. In this report, ultrasound guided transcutaneous embolization of a uterine arteriovenous malformation, using color Doppler, was successfully performed in one patient with intractable vaginal bleeding. There were no complications following the procedure, and complete cessation of blood flow in the uterine arteriovenous malformation was achieved. This technique may be an alternative treatment option for recurrent heavy vaginal bleeding secondary to uterine arteriovenous malformation.

Introduction

Uterine arteriovenous malformations (UAVMs) are a rare cause of uterine bleeding, however, they can be life threatening. UAVMs can be congenital or can result from trauma to the uterine wall, in which case they can be referred to as uterine arteriovenous fistulas (UAVFs) [1]. The introduction of color Doppler and magnetic resonance imaging has proven helpful in the diagnosis of small uterine arteriovenous malformations/fistulas, supporting the hypothesis that the incidence is not as low as once thought.

Conflicts of interest: All contributing authors declare no conflicts of interest.

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UAVM/Fs must not be confused with retained products of conception, since the therapeutic approach is completely different, and the result can be catastrophic [2]. Hysterectomy is the definitive treatment for symptomatic UAVM/F, however, since it is more common in women of childbearing age, angiographic embolization is the preferred conservative approach [3,4].

Case report

A 22-year-old gravida 2 para 1 presented with recurrent heavy vaginal bleeding, suprapubic cramping pain, and symptomatic anemia. She had one episode of acute excessive vaginal blood loss that required hospitalization and blood transfusion. Her obstetric history included a first trimester elective abortion with dilation and curettage, performed ~2 months prior to her clinical presentation. Ultrasound with Doppler showed no evidence of retained products of conception within the endometrial cavity, although an area of increased vascularity in the uterine fundus was noted (Fig. 1). Close detailed evaluation of this area, with pulse Doppler, demonstrated a dominant feeding artery and a dominant draining vein. In addition, arterialization of the draining vein was noted, supporting the diagnosis of uterine arteriovenous malformation/fistula. The patient was referred to interventional radiology for further evaluation and possible embolization.

The uterine arteriovenous malformation/fistula was accurately localized with color Doppler ultrasound, and review of her images showed no interposing bowel segments between the anterior abdominal wall and the uterus. Therefore, a transcutaneous approach was considered due to the apparent ease of access, relative to the angiographic approach.

A detailed discussion between the patient and her clinical team, regarding the risks and benefits associated with Doppler ultrasound guided embolization, ensued. The patient acceded to the alternative approach due to lack of need for intravenous contrast administration or radiation exposure.

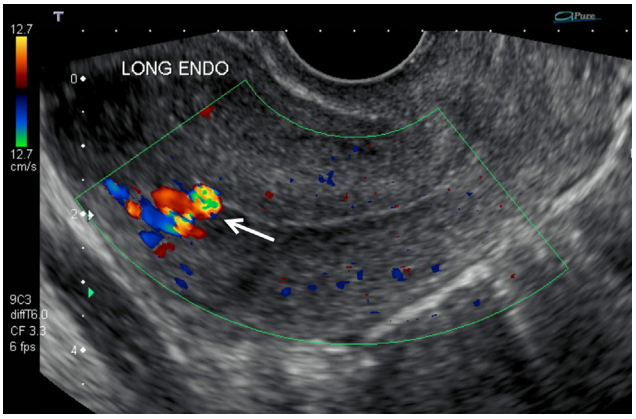

Fig. 1 Transvaginal Doppler ultrasound of the uterus shows enlarged, high flow, serpigenous vessel (white arrow), located in the posterior wall of the uterus, towards the fundus, suggestive of uterine arteriovenous malformation/fistula.

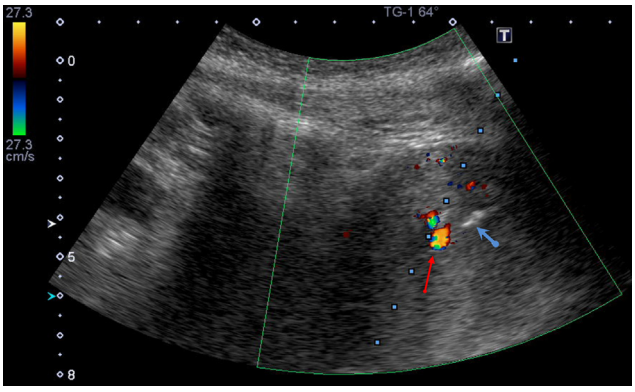

Fig. 2 Transabdominal ultrasound image of the uterus with Doppler obtained during embolization shows the tip of the 20-gauge, 89-mm spinal needle (blue arrow) pointing toward the arteriovenous malformation, located in the posterior fundal aspect of the uterus (red arrow).

A 20-gauge spinal needle was selected to access the UAVM/F. The access was performed using an oblique orientation, in relation to the flow of the feeding artery (Fig. 2). After access was achieved under grayscale and Doppler ultrasound guidance, the spinal needle stylet was removed, and a good return of arterial blood was documented. Next, one MWCE-18S-4/2-.018 Tornado coil (Cook Inc., Bloomington, IN, USA) was deployed via the spinal needle into the UAVM/F (Fig. 3). The spinal needle was slowly retrieved to deploy the distal end of the coil in the myometrium, minimizing theoretical risk of coil migration.

Follow-up Doppler ultrasound demonstrated significant reduction in blood flow in the UAVM/F; however, persistent slow flow was noted (Figs. 4 and 5). The location of the spinal needle was slightly adjusted to re-access the residual flow in the UAVM/F under color Doppler guidance (Fig. 6). Subsequently, a single Gelfoam torpedo (Absorbable Gelatin Compressed Sponge; Pfizer, New York, NY, USA) mixed with thrombin (1000 U/mL, Recothrom 5000 units; ZymoGenetics Inc., Seattle, WA, USA) was deployed into

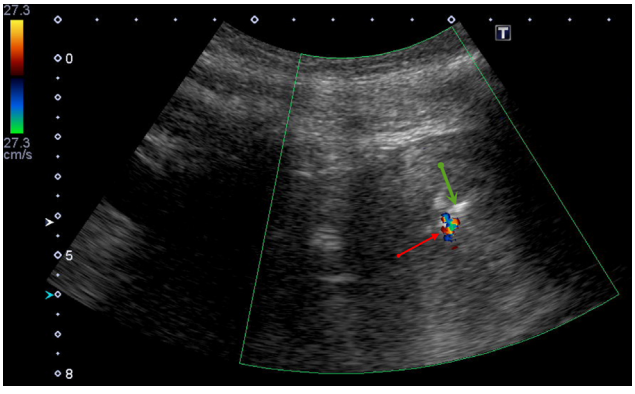

Fig. 3 Ultrasound image of the uterus with Doppler after deployment of the coil shows the tip of the needle (green arrow) next to residual blood flow in the arteriovenous fistula (red arrow). The flow had significantly decreased when compared to pre-embolization image.

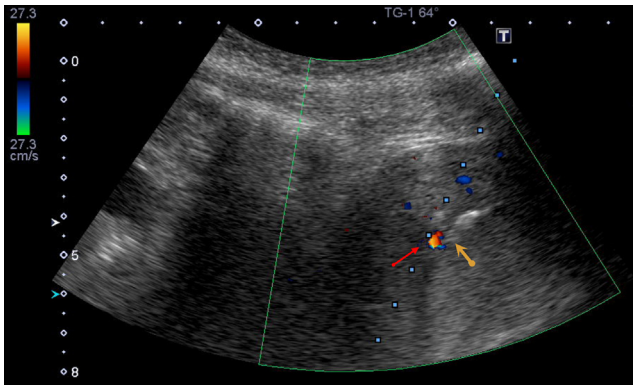

Fig. 4 Ultrasound image of the uterus with Doppler after deployment of the coil shows residual blood flow in the arteriovenous fistula (red arrow) and the deployed 2—4 mm tornado coil is also noted (yellow arrow).

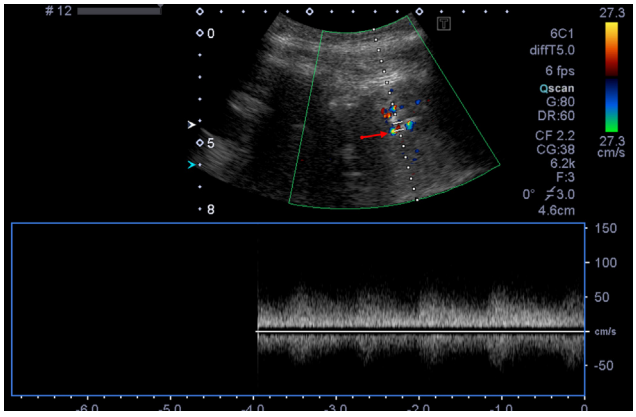

Fig. 5 Pulse Doppler ultrasound after deployment of the coil demonstrates decrease in the flow; however, persistent low resistance arterial flow is recorded, suggestive of noncomplete response to coil deployment.

the UAVM/F via the 20 gauge spinal needle, resulting in complete cessation of blood flow in the UAVM/F (Figs. 7 and 8).

The patient was discharged the following morning, after a follow-up Doppler ultrasound was obtained, documenting complete cessation of flow in the UAVM/F (Fig. 9). The patient reported no further bleeding and her hemoglobin and hematocrit levels were normal on her follow-up visit 2 months later. One year following embolization, the patient presented to the emergency room with vaginal bleeding and a positive pregnancy test. Transvaginal ultrasound showed normal flow in the uterus and no signs of UAVM/F on Doppler ultrasound. The coil was easily identified on ultrasound in the same location without evidence of migration. The patient was diagnosed with miscarriage in progress and discharged home.

Discussion

Patients with UAVM/Fs present with abnormal uterine bleeding that frequently requires blood transfusions, and

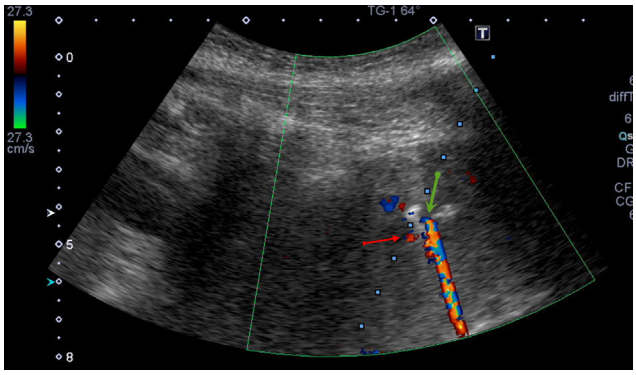

Fig. 6 Doppler ultrasound image shows the tip of the needle (green arrow) redirected toward the residual flow in the arteriovenous fistula (red arrow). Twinkle artifacts from the deployed coil are clearly noted (green arrow).

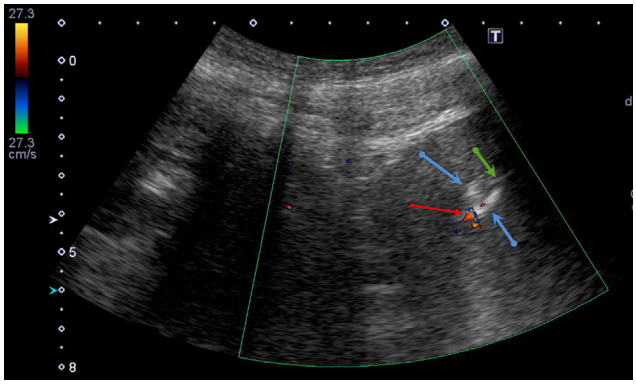

Fig. 7 Echogenic lines are noted in the uterine fundus after deployment of gelfoam torpedoes (blue arrows). The flow in the fistula almost completely stopped on color Doppler.

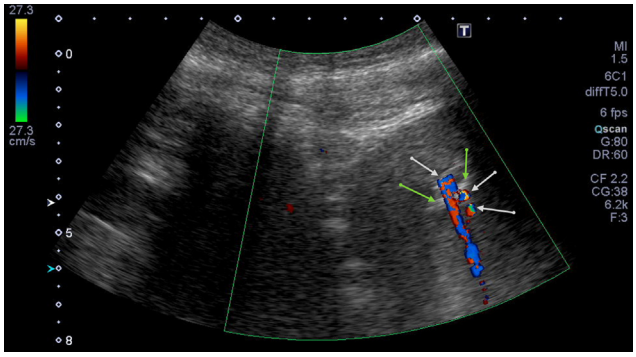

Fig. 8 Doppler ultrasound shows complete closure of the arteriovenous fistula, after coil (green arrows) and gelfoam torpedoes (white arrows) have been deployed. Only twinkle artifacts are noted without definite vascular flow.

can be life threatening. It is hypothesized that the congenital type of UAVM occurs due to arrested embryonic development of uterine vasculature, while the acquired type occurs due to formation of a pathological communication between a single artery and a single vein during the healing phase of a uterine wall trauma. This trauma can be

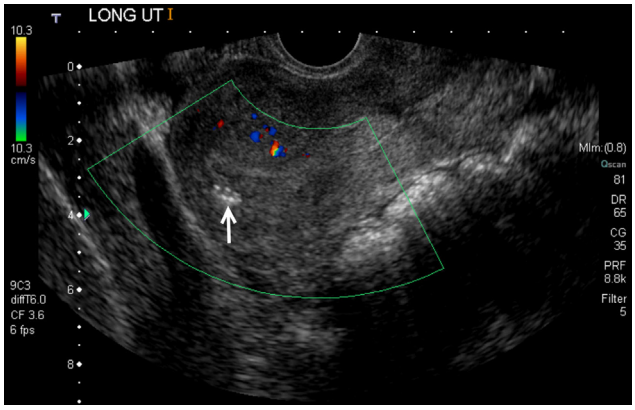

Fig. 9 Transvaginal color Doppler image of the uterus, obtained 1 year following embolization, shows echogenic focus in the posterior wall, toward the fundus, corresponding to the coil. No sonographic evidence of arteriovenous fistula is present on the follow-up study.

caused by obstetric procedures and/or obstetric malignancies [5—7]. Management approaches range from watchful waiting to hysterectomy, depending on clinical presentation. Angiographic embolization of UAVM/Fs has been the treatment of choice for management in patients of child-bearing age [8—11]. However, it subjects patients to significant doses of radiation to the pelvis, as well as the potential risks associated with administration of iodinated contrast agents. Transcutaneous embolization of UAVM/Fs can be achieved in select cases, using Doppler ultrasound guidance. Following appropriate patient evaluation, the procedure can be completed in ~15 minutes, with no need for radiation exposure or use of intravenous contrast agents. This technique allows for immediate post-procedural evaluation to determine whether additional interventions are required. Given the less invasive nature of the procedure, the patient can be discharged shortly thereafter, and, since it is a selective embolization, this technique should have no adverse effects on future pregnancies.

Like any transcutaneous approach in the abdomen and/or pelvis, the risk of bowel injury should always be considered. Therefore, a safe approach should be carefully planned. It is worthy to note that a blunt tip needle is not advised, given the stiff nature of uterine musculature. Access to the UAVM/F should be obtained from the arterial side, at a steep angle in relation to the feeding artery. Good blood return through the needle should be appreciated prior to coil deployment.

The main limitations to ultrasound guided transcutaneous embolization are: an increased distance to embolization site (> 15 cm); risk of air contamination with subsequent dirty shadowing; and twinkle artifacts after coil/gelfoam deployment. These limitations can be overcome by saline flushing of needles before placement (to minimize air contamination), and manipulating scanning windows, using grayscale and color Doppler.

This report reflects our experience in the diagnosis and management of traumatic uterine arteriovenous fistula in a patient of child-bearing age. The UAVM/F was localized with color Doppler ultrasound, and embolization was achieved via a transcutaneous rather than an angiographic approach, with subsequent complete cessation of blood flow in the fistula, and instant resolution of vaginal bleeding. This approach is less time consuming, does not require radiation exposure and/or iodinated contrast agents. On 2-month follow-up, the patient had complete resolution of menorrhagia with normalization of hemoglobin and hematocrit levels. On 1-year follow- up, transvaginal ultrasound demonstrated normal flow in the uterus without evidence of recurrence.

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